

CLAIMS:

1. A producing method for producing an asymmetric alkyl compound by an asymmetric synthesis reaction between a glycine imine ester and an alkyl halide, comprising:

a synthesizing step of carrying out the asymmetric synthesis reaction by mixing (i) a reaction solution containing the glycine imine ester, the alkyl halide, and an asymmetric catalyst having a catalytic action which causes the asymmetric synthesis reaction to proceed with (ii) an alkali-treated solid support obtained by treating with an alkaline substance a solid support made of an inorganic compound.

2. The producing method as set forth in claim 1, wherein said mixing is carried out so that the reaction solution is formed as a thin film on a surface of the alkali-treated solid support.

3. The producing method as set forth in claim 1, wherein said mixing is carried out by dropping the reaction solution onto the alkali-treated solid support.

4. The producing method as set forth in any one of claims 1 to 3, wherein the alkali-treated solid support is a powder.

5. The producing method as set forth in any one of claims 1 to 4, wherein after said mixing, a mixture of the reaction solution and the alkali-treated solid support is dried and then is subjected to a microwave irradiation treatment.

6. The producing method as set forth in any one of claims 1 to 5, wherein the solid support is any one of a clay mineral and an inorganic oxide.

7. The producing method as set forth in claim 6, wherein the inorganic oxide is any one of a metal oxide and a silicone oxide.

8. The producing method as set forth in any one of claims 1 to 5, wherein the solid support is any one selected from a group consisting of alumina, kaolin, kaolinite, montmorillonite, bentonite, celite, zeolite, and diatomous earth.

9. The producing method as set forth in any one of claims 1 to 8, wherein used as the alkaline substance for treating the solid support is an aqueous solution of an alkali compound.

10. The producing method as set forth in claim 9, wherein used as the alkali compound is a hydroxide of alkali

metal or a hydroxide of alkaline earth metal.

11. The producing method as set forth in claim 9 or 10, wherein the alkali-treated solid support is obtained by a preparation method including (i) a treating step of treating the solid support with the aqueous solution of the alkali compound, and (ii) a drying step of drying the solid support thus treated.

12. The producing method as set forth in claim 11, wherein in said drying step, the treated solid support is subjected to a microwave irradiation treatment so as to be dried.

13. The producing method as set forth in claim 9 or 10, wherein the alkali-treated solid support is obtained by a preparation method including (i) a treating step of treating the solid support with the aqueous solution of the alkali compound, and (ii) a wet-state step of changing the treated solid support into a wet state.

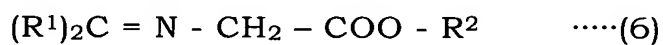
14. The producing method as set forth in claim 13, wherein in said wet-state step, moisture in the treated solid support is removed so that the amount of the moisture is in a range from 0.1% by weight to 50% by weight.

15. The producing method as set forth in any one of claims 1 to 14, wherein the asymmetric catalyst is a cinchonidine-based compound or a cinchonine-based compound.

16. The producing method as set forth in any one of claims 1 to 15, wherein the asymmetric catalyst is cinchonine or an N-anthracenyl methyl cinchonidinium chloride.

17. The producing method as set forth in any one of claims 1 to 14, wherein the asymmetric catalyst is an N-spiro quaternary ammonium salt.

18. The producing method as set forth in any one of claims 1 to 17, wherein the glycine imine ester has a structure shown by Formula (6) below,



where each of R^1 and R^2 denotes a monovalent organic group.

19. The producing method as set forth in claim 18, wherein the organic group denoted by R^1 in Formula (6) is an alkyl group having an aromatic structure.

20. The producing method as set forth in claim 18 or 19, wherein the organic group denoted by R^2 in Formula (6)

includes a side chain having three or more carbons.

21. The producing method as set forth in claim 20, wherein the organic group denoted by R^2 is a t-butyl group (a methyl propyl group).

22. The producing method as set forth in claim 18, wherein the glycine imine ester is an N-dimethylphenylmethyleneglycine t-butyl ester.

23. The producing method as set forth in any one of claims 1 to 22, wherein the alkyl halide has a structure shown by Formula (7) below,



where R^3 denotes a monovalent organic group, and X denotes a halogen atom.

24. The producing method as set forth in claim 23, wherein the halogen is bromine (Br), fluorine (F), iodine (I), or chlorine (Cl).

25. The producing method as set forth in claim 23 or 24, wherein the organic group denoted by R^3 is an alkyl group.

26. An alkali-treated solid support used in the

synthesizing step of the producing method as set forth in any one of claims 1 to 25,

the alkali-treated solid support being obtained by (i) treating a powder of the solid support, made of the inorganic compound, with the aqueous solution of the alkali compound, and then (ii) drying the treated powder by the microwave irradiation treatment.

27. An alkali-treated solid support used in the synthesizing step of the producing method as set forth in any one of claims 1 to 25,

the alkali-treated solid support being obtained by (i) treating a powder of the solid support, made of the inorganic compound, with the aqueous solution of the alkali compound, and then (ii) changing the treated powder into the wet state.

28. An alkali-treated solid support used in the synthesizing step of the producing method as set forth in any one of claims 1 to 25,

the alkali-treated solid support being obtained by (i) treating a powder of the solid support, made of the inorganic compound, with the aqueous solution of the alkali compound, and then (ii) removing moisture from the treated powder so that an amount of the moisture in the treated powder is in a range from 0.1% by weight to 50% by weight.

29. The alkali-treated solid support as set forth in any one of claims 26 to 28, being, after the synthesizing step, (i) washed with a washing solvent and then (ii) dried or changed into the wet state, so as to be reusable.

30. The alkali-treated solid support as set forth in claim 29, wherein the washing solvent is a solvent used for the reaction solution.